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field. The data relative to the plates and the magnitudes obtained from them (corrected for atmospheric extinction) are as follows:

Plate	Date	Length of Exposures	No. Comp. Stars	Pg. Mag.
3484	1916, Oct. 18	32 ^m	7	18.29
3487	Oct. 19	32	7	18.32

The adopted photographic magnitude, 18.3, applies to a time five days before the present opposition. Reducing to the mean opposition we obtain magnitude 18.6. On the basis of this determination the photographic magnitudes of the seventh and eighth satellites are between 17.5 and 18.0.

The size of the Ninth Satellite is readily computed once we know the albedo. Estimating the color-index at one magnitude and assuming a value of the visual albedo similar to that of the Moon, *Pallas*, and *Ceres* ($p = 0.1$ in Russell's formulæ, *Astrophysical Journal*, **43**, 177, 1916) we find that the angular diameter at mean opposition is $0''.009$. If we assume a higher reflecting power, for instance $p = 0.25$, a value near that of *Juno*, the diameter is $0''.006$. The comparison of this satellite with the asteroids is obviously better than assuming for it a close similarity in reflecting power to the four largest satellites of *Jupiter* for which the mean value of p is 0.35.

The linear diameter of the Ninth Satellite at mean opposition is 17.4 miles on the first assumption above, and on the second is 11.2 miles. The true value is probably within these limits.

SETH B. NICHOLSON.

HARLOW SHAPLEY.

A NEW VARIABLE STAR.

In the course of the investigation of star colors in the southern globular cluster Messier 9 (N. G. C. 6333) several objects have been found for which the light apparently varies thru small intervals. One star, however, whose position with respect to the center of the cluster is

$$\Delta\alpha = 7^s.4 \quad \Delta\delta = -1' 18''$$

shows a conspicuous short-period variation. It is brighter than normal on plates made April 26 and June 4, 1916, and of intermediate brightness or faint on March 29, April 27,

April 28, July 6 and July 7, 1916. From comparisons with Polar Standards it appears that the range of variation is in excess of a magnitude. At maximum the star is photographically fainter than magnitude 16.5. It is, therefore, probably the faintest variable star so far discovered.

HARLOW SHAPLEY.

ON THE OBSERVED ROTATIONS OF PLANETARY NEBULÆ.

Our spectrographic observations for the detection of evidences of rotation in the brighter planetary nebulæ, reported upon in these PUBLICATIONS, Vol. 28, pp. 119-20, June, 1916, have been continued during the summer and fall months. We have tested nearly forty planetaries. About twenty give definite evidence of rotational motions, or relative motions within the nebulæ. For a half dozen others we suspect that the nebular lines are inclined to their normal directions in some cases and distorted from straightness in others, as Doppler effects resulting from motions. In about fifteen cases no indications of rotation or relative motion within the nebulæ have been found.

In general the larger planetaries, and in general the nebulæ whose elliptic outlines have the greatest eccentricities, give the strongest evidences of rotation or internal motion.

The smallest nebulæ and the nebulæ whose outlines are most nearly circular are the ones in which the tests for rotation have failed. Failure with very small nebulæ may arise from the difficulty in guiding with sufficient accuracy throughout the long exposures, and, in the case of the circular, to the possibility that the axis of rotation is pointed approximately toward the observer. It is apparent that in the latter case the spectrographic method cannot hope to succeed.

A number of the ring nebulæ give lines of such form as to suggest that the observed phenomena result from a combination of rotational motion and other type or types of motion. We are not prepared to interpret the phenomena, but in certain cases a motion of nebular materials toward the central nuclei of the objects is at least suggested, and for other nebulæ the complications seem to be due to absorption